



**National
Transportation
Safety Board**

Enhancing Transportation Safety: The Critical Role of Sleep

Mark R. Rosekind, Ph.D.
Board Member

California Sleep Society
October 11, 2014

Federal Agencies: Transportation

NTSB

FMCSA

FRA

NHTSA

PHMSA

DOT

MARAD

FTA

FHWA

FAA



NTSB



NTSB



- 1) determining the probable cause of transportation accidents**
- 2) making recommendations to prevent their recurrence**



NTSB



All Modes



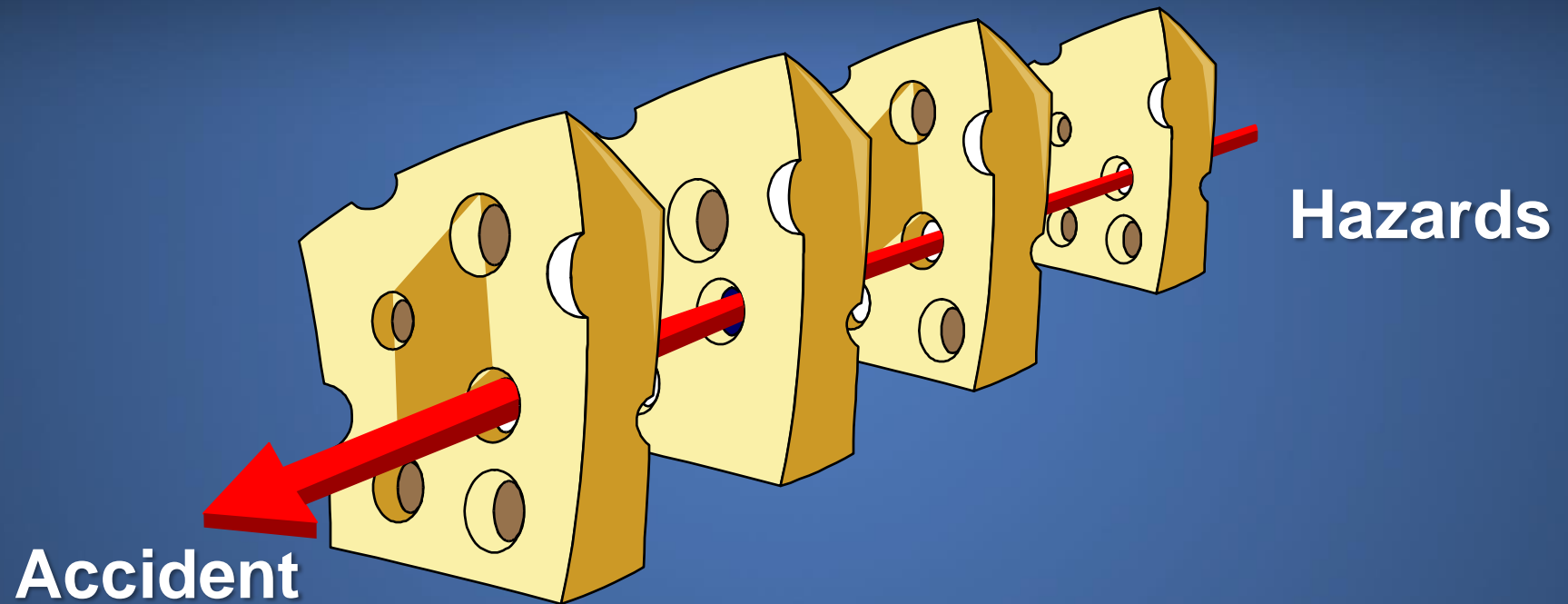
NTSB

Independent Federal Agency: Created in 1967

- >132,000 accident investigations
- 13,500+ safety recommendations
- ~ 2,500 organizations/recipients
- 82% acceptance rate



“Swiss Cheese” Model (Reason)



Successive layers of defenses, barriers, and safeguards



NTSB

Commercial Vehicle Collision with Passenger Vehicle and Motor Coach (Orland, CA; 4/10/14)



NTSB

Organizational Meeting
Groups and Parties
Progress meetings
Media Briefings
Press Releases

 FEDERAL BUREAU OF INVESTIGATION U.S. DEPARTMENT OF JUSTICE	I-7578 (Rev. 03-04-2004)		File #	
	Document Date: 02/12/2008		Investigated By:	
	Occurrence Type: Accident			
Date Rec'd:	Date:	City:	State:	Time Zone:
File #	0412	2017		
Agent Information				
Signature Name:	Agent: Theodoros			Agent File Number:
Agency:	DOWNSIDE FBI INC			DMS-442
Type of Assignment:	Assignment: All Assign?			
Date of Turnover:	MM	DD	Year	Time
Reassignment Signifying Party: No	Air Modest Transport Flight No:			
Remarks:				
Remarks: (1) (b)(7)(C), (b)(7)(D), (b)(7)(F), (b)(7)(G), (b)(7)(H), (b)(7)(I), (b)(7)(J), (b)(7)(K), (b)(7)(L), (b)(7)(M), (b)(7)(N), (b)(7)(O), (b)(7)(P), (b)(7)(Q), (b)(7)(R), (b)(7)(S), (b)(7)(T), (b)(7)(U), (b)(7)(V), (b)(7)(W), (b)(7)(X), (b)(7)(Y), (b)(7)(Z), (b)(7)(AA), (b)(7)(AB), (b)(7)(AC), (b)(7)(AD), (b)(7)(AE), (b)(7)(AF), (b)(7)(AG), (b)(7)(AH), (b)(7)(AI), (b)(7)(AJ), (b)(7)(AK), (b)(7)(AL), (b)(7)(AM), (b)(7)(AN), (b)(7)(AO), (b)(7)(AP), (b)(7)(AQ), (b)(7)(AR), (b)(7)(AS), (b)(7)(AT), (b)(7)(AU), (b)(7)(AV), (b)(7)(AW), (b)(7)(AX), (b)(7)(AY), (b)(7)(AZ), (b)(7)(BA), (b)(7)(BB), (b)(7)(BC), (b)(7)(BD), (b)(7)(BE), (b)(7)(BF), (b)(7)(BG), (b)(7)(BH), (b)(7)(BI), (b)(7)(BJ), (b)(7)(BK), (b)(7)(BL), (b)(7)(BM), (b)(7)(BN), (b)(7)(BO), (b)(7)(BP), (b)(7)(BQ), (b)(7)(BR), (b)(7)(BS), (b)(7)(BT), (b)(7)(BU), (b)(7)(BV), (b)(7)(BW), (b)(7)(BX), (b)(7)(BY), (b)(7)(BZ), (b)(7)(CA), (b)(7)(CB), (b)(7)(CC), (b)(7)(CD), (b)(7)(CE), (b)(7)(CF), (b)(7)(CG), (b)(7)(CH), (b)(7)(CI), (b)(7)(CJ), (b)(7)(CK), (b)(7)(CL), (b)(7)(CM), (b)(7)(CN), (b)(7)(CO), (b)(7)(CP), (b)(7)(CQ), (b)(7)(CR), (b)(7)(CS), (b)(7)(CT), (b)(7)(CU), (b)(7)(CV), (b)(7)(CW), (b)(7)(CX), (b)(7)(CY), (b)(7)(CZ), (b)(7)(DA), (b)(7)(DB), (b)(7)(DC), (b)(7)(DD), (b)(7)(DE), (b)(7)(DF), (b)(7)(DG), (b)(7)(DH), (b)(7)(DI), (b)(7)(DJ), (b)(7)(DK), (b)(7)(DL), (b)(7)(DM), (b)(7)(DN), (b)(7)(DO), (b)(7)(DP), (b)(7)(DQ), (b)(7)(DR), (b)(7)(DS), (b)(7)(DT), (b)(7)(DU), (b)(7)(DV), (b)(7)(DW), (b)(7)(DX), (b)(7)(DY), (b)(7)(DZ), (b)(7)(EA), (b)(7)(EB), (b)(7)(EC), (b)(7)(ED), (b)(7)(EE), (b)(7)(EF), (b)(7)(EG), (b)(7)(EH), (b)(7)(EI), (b)(7)(EJ), (b)(7)(EK), (b)(7)(EL), (b)(7)(EM), (b)(7)(EN), (b)(7)(EO), (b)(7)(EP), (b)(7)(EQ), (b)(7)(ER), (b)(7)(ES), (b)(7)(ET), (b)(7)(EU), (b)(7)(EV), (b)(7)(EW), (b)(7)(EX), (b)(7)(EY), (b)(7)(EZ), (b)(7)(FA), (b)(7)(FB), (b)(7)(FC), (b)(7)(FD), (b)(7)(FE), (b)(7)(FF), (b)(7)(FG), (b)(7)(FH), (b)(7)(FI), (b)(7)(FJ), (b)(7)(FK), (b)(7)(FL), (b)(7)(FM), (b)(7)(FN), (b)(7)(FO), (b)(7)(FP), (b)(7)(FQ), (b)(7)(FR), (b)(7)(FS), (b)(7)(FT), (b)(7)(FU), (b)(7)(FV), (b)(7)(FW), (b)(7)(FX), (b)(7)(FY), (b)(7)(FZ), (b)(7)(GA), (b)(7)(GB), (b)(7)(GC), (b)(7)(GD), (b)(7)(GE), (b)(7)(GF), (b)(7)(GG), (b)(7)(GH), (b)(7)(GI), (b)(7)(GJ), (b)(7)(GK), (b)(7)(GL), (b)(7)(GM), (b)(7)(GN), (b)(7)(GO), (b)(7)(GP), (b)(7)(GQ), (b)(7)(GR), (b)(7)(GS), (b)(7)(GT), (b)(7)(GU), (b)(7)(GV), (b)(7)(GW), (b)(7)(GX), (b)(7)(GY), (b)(7)(GZ), (b)(7)(HA), (b)(7)(HB), (b)(7)(HC), (b)(7)(HD), (b)(7)(HE), (b)(7)(HF), (b)(7)(HG), (b)(7)(HH), (b)(7)(HI), (b)(7)(HJ), (b)(7)(HK), (b)(7)(HL), (b)(7)(HM), (b)(7)(HN), (b)(7)(HO), (b)(7)(HP), (b)(7)(HQ), (b)(7)(HR), (b)(7)(HS), (b)(7)(HT), (b)(7)(HU), (b)(7)(HV), (b)(7)(HW), (b)(7)(HX), (b)(7)(HY), (b)(7)(HZ), (b)(7)(IA), (b)(7)(IB), (b)(7)(IC), (b)(7)(ID), (b)(7)(IE), (b)(7)(IF), (b)(7)(IG), (b)(7)(IH), (b)(7)(II), (b)(7)(IJ), (b)(7)(IK), (b)(7)(IL), (b)(7)(IM), (b)(7)(IN), (b)(7)(IO), (b)(7)(IP), (b)(7)(IQ), (b)(7)(IR), (b)(7)(IS), (b)(7)(IT), (b)(7)(IU), (b)(7)(IV), (b)(7)(IW), (b)(7)(IX), (b)(7)(IY), (b)(7)(IZ), (b)(7)(JA), (b)(7)(JB), (b)(7)(JC), (b)(7)(JD), (b)(7)(JE), (b)(7)(JF), (b)(7)(JG), (b)(7)(JH), (b)(7)(JI), (b)(7)(JJ), (b)(7)(JK), (b)(7)(JL), (b)(7)(JM), (b)(7)(JN), (b)(7)(JO), (b)(7)(JP), (b)(7)(JQ), (b)(7)(JR), (b)(7)(JS), (b)(7)(JT), (b)(7)(JU), (b)(7)(JV), (b)(7)(JW), (b)(7)(JX), (b)(7)(JY), (b)(7)(JZ), (b)(7)(KA), (b)(7)(KB), (b)(7)(KC), (b)(7)(KD), (b)(7)(KE), (b)(7)(KF), (b)(7)(KG), (b)(7)(KH), (b)(7)(KI), (b)(7)(KJ), (b)(7)(KL), (b)(7)(KM), (b)(7)(KN), (b)(7)(KO), (b)(7)(KP), (b)(7)(KQ), (b)(7)(KR), (b)(7)(KS), (b)(7)(KT), (b)(7)(KU), (b)(7)(KV), (b)(7)(KW), (b)(7)(KX), (b)(7)(KY), (b)(7)(KZ), (b)(7)(LA), (b)(7)(LB), (b)(7)(LC), (b)(7)(LD), (b)(7)(LE), (b)(7)(LF), (b)(7)(LG), (b)(7)(LH), (b)(7)(LI), (b)(7)(LJ), (b)(7)(LK), (b)(7)(LL), (b)(7)(LM), (b)(7)(LN), (b)(7)(LO), (b)(7)(LP), (b)(7)(LQ), (b)(7)(LR), (b)(7)(LS), (b)(7)(LT), (b)(7)(LU), (b)(7)(LV), (b)(7)(LW), (b)(7)(LX), (b)(7)(LY), (b)(7)(LZ), (b)(7)(MA), (b)(7)(MB), (b)(7)(MC), (b)(7)(MD), (b)(7)(ME), (b)(7)(MF), (b)(7)(MG), (b)(7)(MH), (b)(7)(MI), (b)(7)(MJ), (b)(7)(MK), (b)(7)(ML), (b)(7)(MM), (b)(7)(MN), (b)(7)(MO), (b)(7)(MP), (b)(7)(MQ), (b)(7)(MR), (b)(7)(MS), (b)(7)(MT), (b)(7)(MU), (b)(7)(MV), (b)(7)(MW), (b)(7)(MX), (b)(7)(MY), (b)(7)(MZ), (b)(7)(NA), (b)(7)(NB), (b)(7)(NC), (b)(7)(ND), (b)(7)(NE), (b)(7)(NF), (b)(7)(NG), (b)(7)(NH), (b)(7)(NI), (b)(7)(NJ), (b)(7)(NK), (b)(7)(NL), (b)(7)(NM), (b)(7)(NN), (b)(7)(NO), (b)(7)(NP), (b)(7)(NQ), (b)(7)(NR), (b)(7)(NS), (b)(7)(NT), (b)(7)(NU), (b)(7)(NV), (b)(7)(NW), (b)(7)(NX), (b)(7)(NY), (b)(7)(NZ), (b)(7)(OA), (b)(7)(OB), (b)(7)(OC), (b)(7)(OD), (b)(7)(OE), (b)(7)(OF), (b)(7)(OG), (b)(7)(OH), (b)(7)(OI), (b)(7)(OJ), (b)(7)(OK), (b)(7)(OL), (b)(7)(OM), (b)(7)(ON), (b)(7)(OO), (b)(7)(OP), (b)(7)(OQ), (b)(7)(OR), (b)(7)(OS), (b)(7)(OT), (b)(7)(OU), (b)(7)(OV), (b)(7)(OW), (b)(7)(OX), (b)(7)(OY), (b)(7)(OZ), (b)(7)(PA), (b)(7)(PB), (b)(7)(PC), (b)(7)(PD), (b)(7)(PE), (b)(7)(PF), (b)(7)(PG), (b)(7)(PH), (b)(7)(PI), (b)(7)(PJ), (b)(7)(PK), (b)(7)(PL), (b)(7)(PM), (b)(7)(PN), (b)(7)(PO), (b)(7)(PP), (b)(7)(PQ), (b)(7)(PR), (b)(7)(PS), (b)(7)(PT), (b)(7)(PU), (b)(7)(PV), (b)(7)(PW), (b)(7)(PX), (b)(7)(PY), (b)(7)(PZ), (b)(7)(QA), (b)(7)(QB), (b)(7)(QC), (b)(7)(QD), (b)(7)(QE), (b)(7)(QF), (b)(7)(QG), (b)(7)(QH), (b)(7)(QI), (b)(7)(QJ), (b)(7)(QK), (b)(7)(QL), (b)(7)(QM), (b)(7)(QN), (b)(7)(QO), (b)(7)(QP), (b)(7)(QQ), (b)(7)(QR), (b)(7)(QS), (b)(7)(QT), (b)(7)(QU), (b)(7)(QV), (b)(7)(QW), (b)(7)(QX), (b)(7)(QY), (b)(7)(QZ), (b)(7)(RA), (b)(7)(RB), (b)(7)(RC), (b)(7)(RD), (b)(7)(RE), (b)(7)(RF), (b)(7)(RG), (b)(7)(RH), (b)(7)(RI), (b)(7)(RJ), (b)(7)(RK), (b)(7)(RL), (b)(7)(RM), (b)(7)(RN), (b)(7)(RO), (b)(7)(RP), (b)(7)(RQ), (b)(7)(RR				

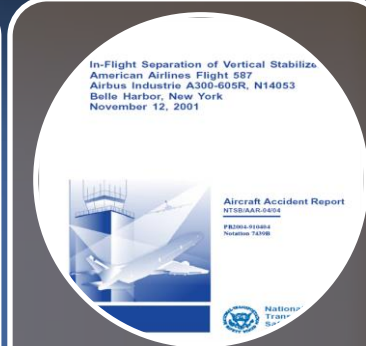
Factual information



Fact finding
Depositions
Witnesses
Docket



Docket
Findings
Conclusions
Probable Cause
Safety
Recommendations



Final Report

Government in the Sunshine Act

Challenges of a 24/7 Society



NTSB

Four Fatigue Factors +

- Sleep loss
- Continuous hours of wakefulness
- Circadian/time of day
- Sleep disorders
- Other considerations



Uncontrolled In-Flight Collision with Terrain AIA Flight 808, Douglas DC-8-61, N814CK U.S. NAS, Guantanamo Bay, Cuba, August 18, 1993

First NTSB aviation accident investigation
to cite fatigue as probable cause

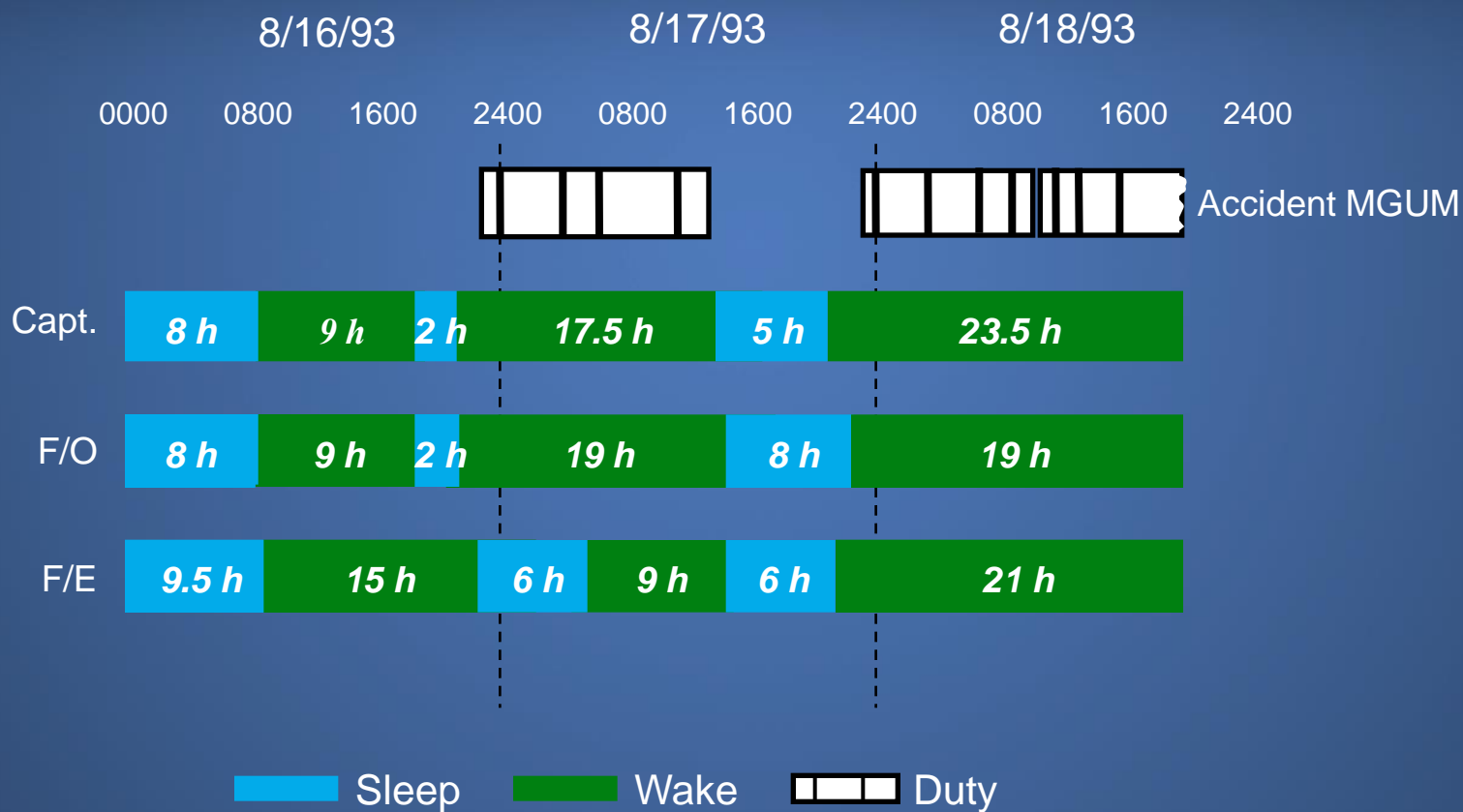


- acute sleep loss, sleep debt, circadian disruption



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Crew Sleep History



Observed Performance Effects

- Degraded decision-making
- Visual/cognitive fixation
- Poor communication/coordination
- Slowed reaction time





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Uncontrolled In-Flight Collision with Terrain
AIA Flight 808, Douglas DC-8-61, N814CK
U.S. NAS, Guantanamo Bay, Cuba, August 18, 1993

“The National Transportation Safety Board determines that the probable causes of this accident were the impaired judgment, decision making, and flying abilities of the captain and flight crew due to the effects of fatigue...”



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Miami, Oklahoma (June 26, 2009)

Fatigue Factors

- Off work for 3 weeks: day active/night sleep schedule
- 3am to 3pm shift work/drive schedule (since 1997)
- Early bedtime (2 hr phase advance in sleep time)
- Obtained min 3 hrs/max 5 hrs sleep prior to accident
- Subsequently diagnosed with mild sleep apnea



10 fatalities
3 serious injuries
2 minor injuries
5 no injuries

**Ford
Windstar**

**Kia
Spectra**

**Hyundai
Sonata**

Source: Oklahoma State Police



Probable Cause (fatigue)

“ . . . driver’s fatigue, caused by the combined effects of acute sleep loss, circadian disruption associated with his shift work schedule, and mild sleep apnea, which resulted in the driver’s failure to react to slowing and stopped traffic ahead by applying the brakes or performing any evasive maneuver to avoid colliding with the traffic queue. . . . ”





**National
Transportation
Safety Board**

Track Path Animation

Collision Between Two BNSF Railway Freight Trains

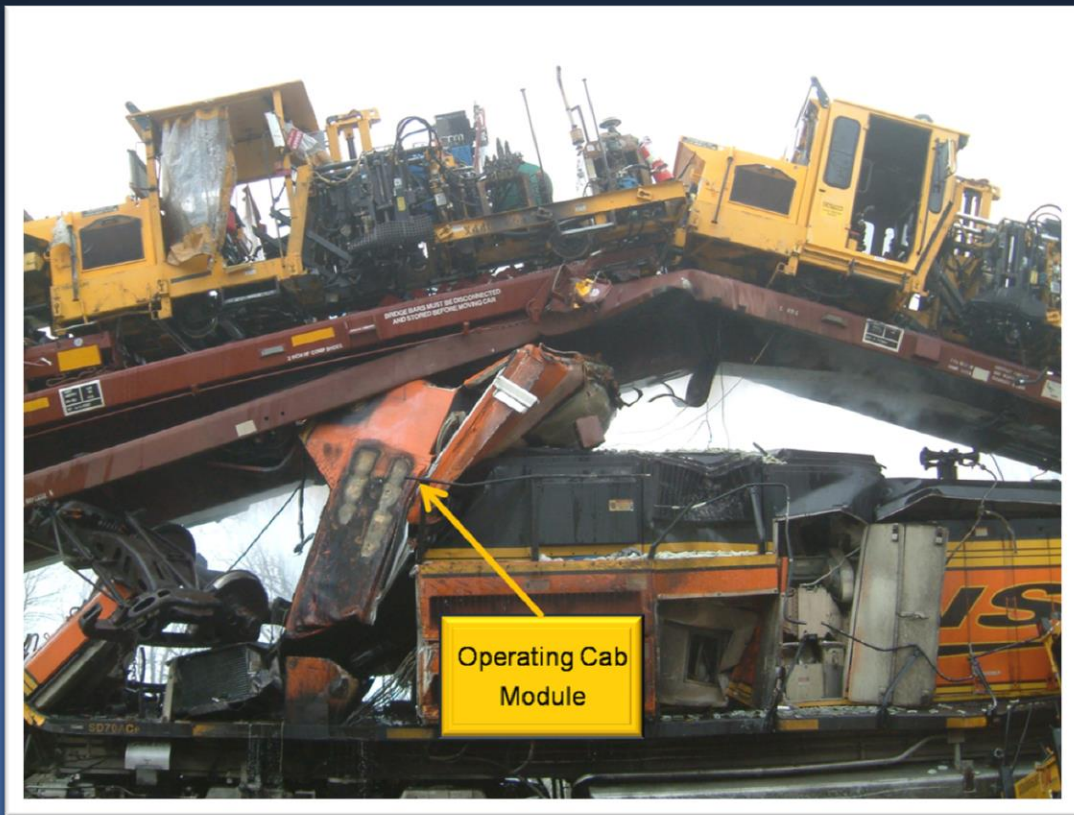
Red Oak, Iowa

April 17, 2011

DCA11FR002



NTSB



NTSB

Probable Cause (fatigue)

“ . . . failure of the crew of the striking train to comply with the signal indication requiring them to operate in accordance with restricted speed requirements and stop short of the standing train because they had fallen asleep due to fatigue resulting from their irregular work schedules and their medical conditions.”





National Transportation Safety Board

Animation of Accident Reconstruction

Motorcoach Run Off Road-Collision with Bridge Signpost

Interstate Highway 95 Southbound
New York, New York
March 12, 2011

HWY11MH005

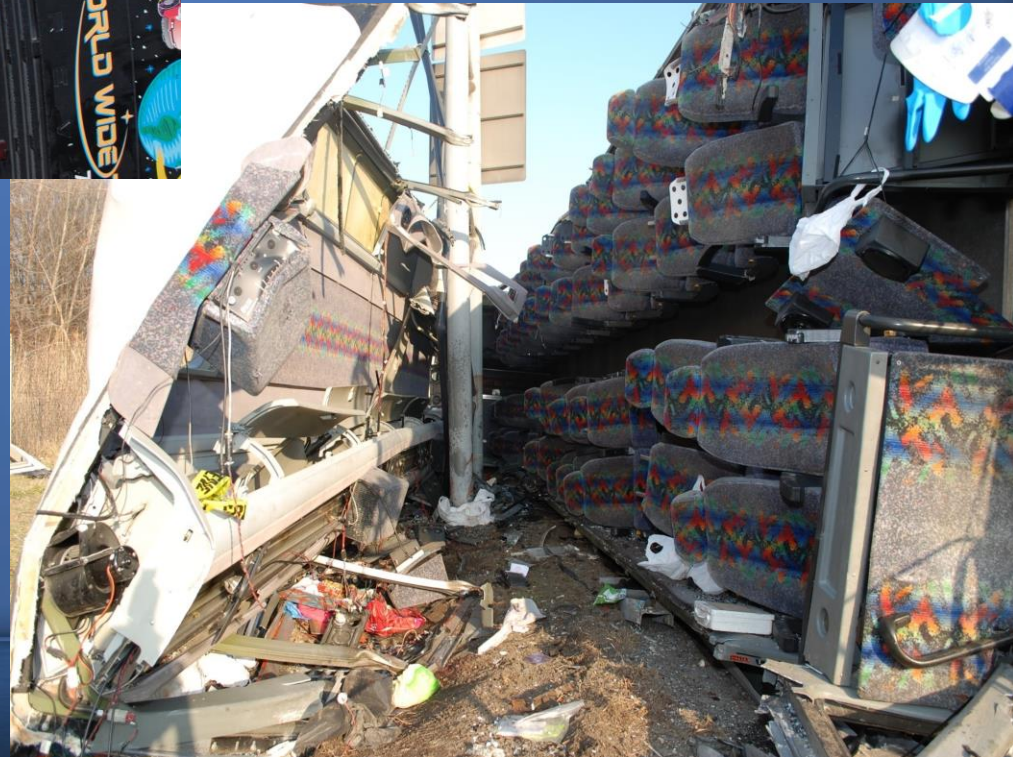


NTSB

'Bronx Bus', New York, NY (March 12, 2011)



15 fatalities
17 injuries



Probable Cause

“The National Transportation Safety Board determines that the probable cause of the accident was the motorcoach driver's failure to control the motorcoach due to fatigue resulting from failure to obtain adequate sleep, poor sleep quality, and the time of day at which the accident occurred.”



Asiana 214 (July 6, 2013)

San Francisco, CA (SFO)



3 fatalities
49 seriously injured



NTSB

Probable Cause

Contributing to the accident were . . .

(5) flight crew fatigue, which likely degraded their performance.





NATIONAL TRANSPORTATION SAFETY BOARD

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MOST WANTED LIST

A program to increase the public's awareness of, and support for, action to adopt safety steps that can help prevent accidents and save lives. The following are ten of the current issues.



Addressing Human
Fatigue



General Aviation
Safety



Safety Management
Systems



Runway Safety



Bus Occupant Safety



Pilot & Air Traffic
Controller
Professionalism



Recorders



Teen Driver Safety



Addressing Alcohol-
Impaired Driving



Motorcycle Safety



NTSB

NTSB Safety Recommendations: Fatigue

- MOST WANTED 1990 - 2011
- >200 fatigue recommendations



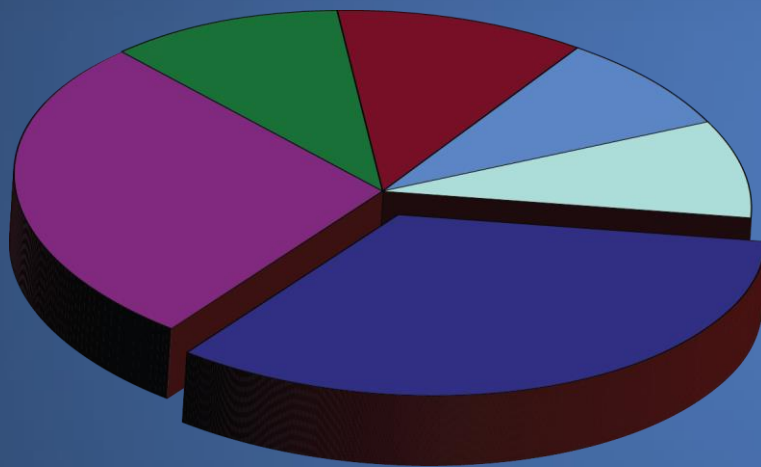
NTSB Safety Recommendations: Fatigue

- 40 years ago: May 10, 1972
- “Revise FAR 135 to provide adequate flight and duty time limitations.” (A-72-55)
- Classified “Closed-Unacceptable”



Complex Issue:

Requires Multiple Solutions



- Scheduling Policies and Practices
- Education/Awareness
- Organizational Strategies
- Healthy Sleep
- Vehicle and Environmental Strategies
- Research and Evaluation



NTSB Fatigue Recommendations: Education/Strategies

- Develop a fatigue education and countermeasures training program
- Educate operators and schedulers
- Include information on use of strategies: naps, caffeine, etc.
- Review and update materials



Scheduling Policies and Practices

Victoria, Texas, January 2, 2008



Victoria, Texas Fire Department

- Day sleep, night drive, ~ 4 am WOCL



NTSB

NTSB Fatigue Recommendations: Hours of Service / Scheduling

- Science-based hours of service
- Allow for at least 8 hours of uninterrupted sleep
- Fatigue mitigation strategies in the hours-of-service regulations for passenger-carrying drivers who operate during the nighttime window of circadian low
- Reduce schedule irregularity and unpredictability



Sleep Apnea

Mexican Hat, UT, January 6, 2008



- 360 rollover, 50/53 ejected, 9 fatalities, OSA (-CPAP)



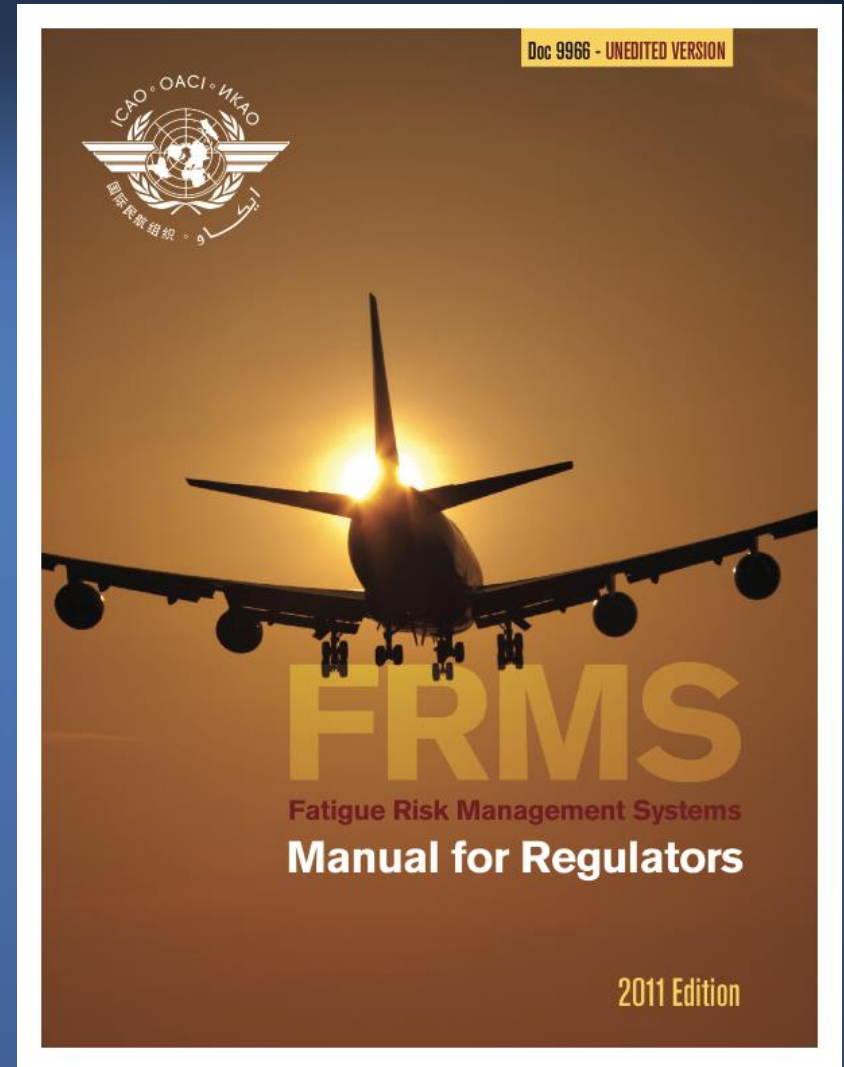
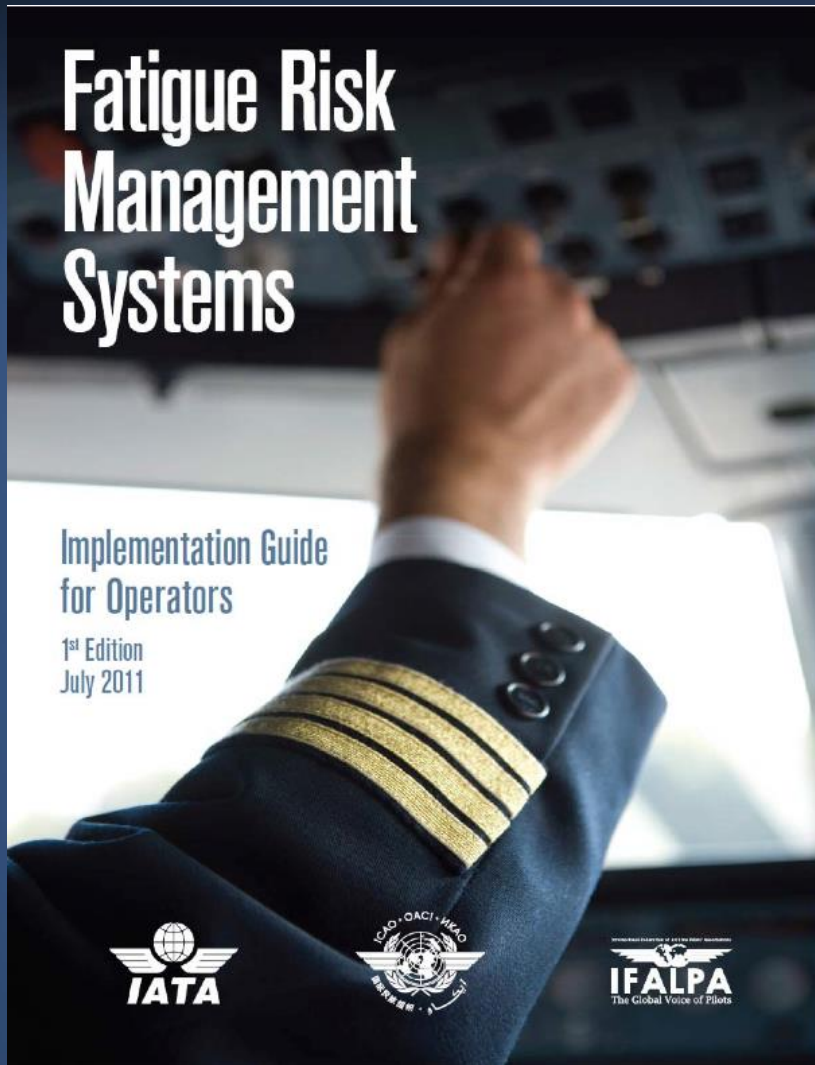
NTSB

NTSB Fatigue Recommendations: Sleep Apnea/Health Related

- Develop standard medical exam to screen for sleep disorders; require its use
- Educate companies and individuals about sleep disorder detection and treatment, and the sedating effects of certain drugs
- Ensure drivers with apnea are effectively treated before granting unrestricted medical certification



Examples



NTSB

NTSB Fatigue Recommendations: Fatigue Management Systems

- Develop guidance based on empirical and scientific evidence for operators to establish fatigue management systems
- Establish an ongoing program to monitor, evaluate, report on, and continuously improve fatigue management programs implemented by motor carriers to identify, mitigate, and continuously reduce fatigue-related risks for drivers.



Go! Flight 1002



- early starts, multiple segment days, sleep apnea



NTSB

1. modify the Application for Airman Medical Certificate to elicit specific information about any previous diagnosis of obstructive sleep apnea and about the presence of specific risk factors for that disorder (A-09-61)

2. implement a program to identify pilots at high risk for obstructive sleep apnea and require that those pilots provide evidence through the medical certification process of having been appropriately evaluated and, if treatment is needed, effectively treated for that disorder before being granted unrestricted medical certification (A-09-62)

3. develop and disseminate guidance for pilots, employers, and physicians regarding the identification and treatment of individuals at high risk of obstructive sleep apnea, emphasizing that pilots who have obstructive sleep apnea that is effectively treated are routinely approved for continued medical certification (A-09-63)





from the Federal Air Surgeon's
PERSPECTIVE...

BY FRED TILTON, MD



NEW OBSTRUCTIVE SLEEP APNEA POLICY

Untreated obstructive sleep apnea is a disqualifying condition for airmen and air traffic control specialists.

OSA is almost universal in obese individuals who have a body mass index over 40 and a neck circumference of 17 inches or more, but up to 30% of individuals with a BMI less than 30 have OSA. —Fred

(December 2013)



NTSB

Strong Industry Opposition . . .

I am... writing...to protest...
implementing a new obstructive sleep apnea policy...

Mark R. Baker
President & CEO



FLYING

EAA, AOPA Condemn Sleep Apnea Rule
By Pia Bergqvist / Published: Nov 21, 2013

MIDWEST FLYER.COM

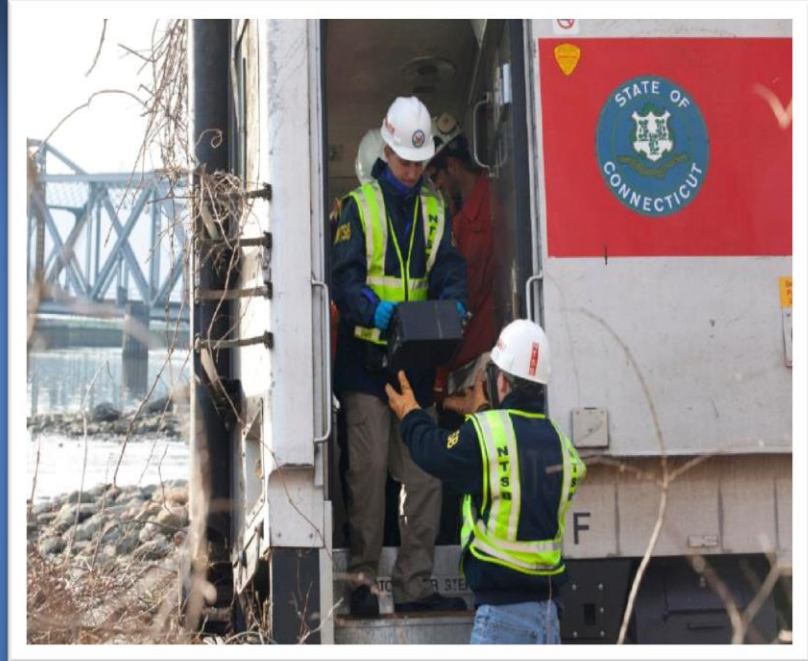
EAA Says FAA's Sleep Apnea Policy Would Set A Dangerous Precedent
November 26, 2014 by mwflyer



NTSB

Bronx Metro North Train Derailment (12/1/13)

- 4 lives lost
- 54 injuries
- \$9 million in damages
- NTSB – ongoing investigation



NTSB



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NTSB Preliminary Report

- Completed on-scene investigation
- Estimated train speed: 82 mph at curve
- Posted speed: 30 mph
- No problems identified: signal system, train brakes, other mechanical equipment
- Tracks in derailment area: fine
- All cars on train and locomotive derailed
- Recorders sent to NTSB labs for analysis



750 - NYDailyNews.com

DAILY NEWS

NEW YORK'S HOMETOWN NEWSPAPER

Metro-North engineer 'basically nodded' just before fatal train derailment: Union official

The New York Times

Train Engineer Was Dazed Before Crash, Lawyer Says

LONG ISLAND

Newsday

Metro-North engineer 'caught himself' nodding before crash, union official says



NTSB



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering
Washington, DC

March 31, 2014

Medical Factual Report

Mary Pat McKay, MD, MPH
Chief Medical Officer

A. ACCIDENT: DCA14MR002

Accident Type:	Train Derailment
Location:	Spuyten Duyvil Station, Bronx, NY
Date:	December 1, 2013
Time:	7:19am
Train#1:	8808
Carrier #1:	Metro North Railroad

E. SUMMARY OF MEDICAL FINDINGS

Post accident testing made an additional diagnosis of severe obstructive sleep apnea. No screening or evaluation for this diagnosis had been performed by any of his medical care providers prior to the accident.



NTSB

CTA Crash – O'Hare Airport (3/24/14)

- 32 injured
- \$6 million estimated in damages
- NTSB ongoing investigation
- NTSB: Operator reported falling asleep



NTSB



CTA Crash – O'Hare Airport (3/24/14)



NTSB

NTSB Preliminary Investigation

CHICAGO SUN-TIMES

CTA operator awoke 'when she hit,'
dozed off before, NTSB says

BY STEFANO ESPOSITO AND ROSALIND ROSSI Staff Reporters March 26, 2014 10:21AM

Chicago Tribune

• — BREAKING NEWS — •
NTSB: Operator in O'Hare crash had
fallen asleep at controls before

Los Angeles Times

Driver in Chicago subway train crash had 'dozed
off,' NTSB says

By Paresh Dave
March 26, 2014 | 9:27 a.m.



NTSB

Manage Sleep = Enhance Safety

- Acknowledge risks
- Educate everyone
- Strong policies
- Take action/use strategies!
- Promote culture change



#40 Ceremonial Swearing In



NTSB

NTSB Board Room (DC)

October 21, 2014



Overcoming the Dangers of
DROWSY DRIVING

National Transportation Safety Board Forum



NTSB

Good sleep, safe travels.



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National Transportation Safety Board